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14. ABSTRACT
The goal of this project is to develop a primer additive that mimics the self-healing ability of skin by forming a polymer scar across scratches. Designed to work with existing military grade primers, Polyfibroblast consists of microscopic, hollow zinc tubes filled with a moisture-cured polyurethane-urea (MCPU). When scratched, the foaming action of a propellant ejects the resin from the broken tubes and completely fills the crack. No catalysts or curing agents are needed since the polymerization is driven by ambient humidity.

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POLYFIBROBLAST: A SELF-HEALING AND GALVANIC PROTECTION ADDITIVE

Progress Report #13

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1 Summary

Planning and preparation for the MTVR field test is underway. The test dates have been set as the week of January 14th. The USMC Corrosion Control team has requested 10 gallons of paint for the test rather than the originally planned 5. PPG is on track to deliver. In initial tests of the 10-gallon batch, PPG has demonstrated a particle size cutoff below 100 μm in the primer, acceptable sprayout, and acceptable adhesion for the Polyfibroblast coating stack.

2 Project Goals and Objectives

PPG will deliver 10 gallons of self-healing paint for the January 14th field test in Camp Lejeune, NC.

3 Key Accomplishments

3.1 Field Test Plans Finalized

PPG and APL conducted a teleconference with Andrew Sheetz and Jay Ong from the USMC corrosion control team. The test will be conducted during the week of January 14th. It will be performed at the Corrosion Repair Facility (CRF) at Camp Lejeune, NC. Representatives from both APL and PPG will be in attendance, and observers from ONR are also welcome to attend.

The current plan is to drop ship all items to Camp Lejeune, including 10 gallons of paint, MSDSs, thinner, spray guns, pans, cups, drop cloths, filters, rags, gloves, and respirators. All attendees must be equipped with steel-toe shoes and overalls. The painter from the CRF will perform the painting. They will paint one half of the truck bed of an MTVR with the self-healing primer, and the other half with Niles zinc-rich primer. On top of the primer will be applied a second layer of CARC primer, followed by the CARC topcoat. All will be applied according to the appropriate military specifications.

PPG will ship the self-healing paint as a two-component mixture. Although APL has proven that the pot life of the primer can be as long as three months, PPG has experienced mixed results, with some primers gelling only hours after adding the microcapsules. To ensure a successful test, the microcapsules and zinc rich primer will be shipped in separate containers and mixed onsite.

With the extra, unused paint, the USMC Corrosion Control Team will also paint a large series of witness panels to undergo accelerated weathering tests along with a large number of other coatings that they are evaluating.

3.2 Final Batch Inspection

PPG has begun testing small aliquots of the 10-gallon batch to qualify them prior to the field test. According to standard protocol, PPG crushed the microcapsules under a microscope to

verify that they possessed hard polymer shells that cracked when broken. PPG also inspected the dispersion of the microcapsules in the MIL-P-26915 primer using a Hegman gauge. The Hegman gauge reported a particle size cutoff below 100 µm, indicating minimal agglomeration. Finally, the self-healing paint aliquots were spray painted on several test panels and tested for adhesion. Spray out showed no obvious issues, and the tape strip adhesion measurements passed specification. Unless new technical issues arise, PPG will complete processing of the roughly 4 kg of microcapsules that are required for 10 gallons of paint.

4 Next Steps

4.1 Field Test

PPG will organize the items necessary for the field test and ship them to the CRF in Camp Lejeune. At least one representative from APL and PPG will make travel plans and attend.